CLAIMS

1. Spectroscopic imaging method using a SSFP-RF excitation pulse sequence having the following features:

- with a repetition time (TR) RF excitation pulses with a flip angle are irradiated onto a test object,

- between the RF excitation pulses, in a first readout window and without the presence of a magnetic field gradient, a FID-like SSFP signal S1 is read out and in a second readout window separate from the first readout window and without the presence of a magnetic field gradient an echo-like SSFP signal S2 is read out,

- before the first readout window at least one phase coding gradient is switched for phase coding in at least one spatial direction and

- before the next RF excitation pulse, at least one phase coding gradient is switched for cancelling out a phase coding in at least one spatial direction.

2. Imaging method according to claim 1, characterized in that the separation of the first and second readout windows takes place by switching a first spoiler gradient between the FID-like SSFP signal S1 and the echo-like SSFP signal S2.

3. Imaging method according to claim 1 or 2, characterized in that the RF excitation pulses are irradiated in layer-selective manner.

4. Imaging method according to claim 3, characterized in that a second spoiler gradient is switched between the FID-like SSFP signal S1 and the echo-like SSFP signal S2 and a frequency-selective saturation pulse is irradiated between the first and second spoiler gradients for suppressing an interfering signal.

5. Imaging method according to claim 3 or 4, characterized in that after the first readout window and before the second readout window successively at least one phase coding gradient is switched for cancelling out the phase coding in at least one

spatial direction and at least one phase coding gradient is switched for phase coding in at least one spatial direction.

6. Imaging method according to claim 1 or 2, characterized in that the RF excitation pulses are frequency-selective.

7. Spectroscopic imaging method using a SSFP-RF excitation pulse sequence having the following features:

- with a repetition time (TR) RF excitation pulses with a flip angle are irradiated onto a test object,
- between the RF excitation pulses, in a single readout window and without the presence of a magnetic field gradient, a single FID-like SSFP signal S1 is read out,
- before the readout window at least one phase coding gradient is switched for phase coding in at least one spatial direction and
- before the next RF excitation pulse at least one phase coding gradient is switched for cancelling out the phase coding.

8. Imaging method according to claim 7, characterized in that after the readout window is switched a first spoiler gradient.

9. Imaging method according to claim 7 or 8, characterized in that the RF excitation pulses are irradiated in layer-selective manner.

10. Imaging method according to claim 9, characterized in that after the readout window is switched a second spoiler gradient and between the first and second spoiler gradients is irradiated a frequency-selective saturation pulse for suppressing an interfering signal.

11. Imaging method according to claim 7 or 8, characterized in that the RF excitation pulses are frequency-selective.

12. Spectroscopic imaging method using a SSFP-RF excitation pulse sequence with the following features:

- with a repetition time (TR) RF excitation pulses with a flip angle are irradiated onto a test object,

- between the RF excitation pulses and in a single readout window without the presence of a magnetic field gradient, a single echo-like SSFP signal S2 is read out,

- before the readout window is switched at least one phase coding gradient for phase coding in at least one spatial direction and

- before the next RF excitation pulse at least one phase coding gradient is switched for cancelling out the phase coding.

13. Imaging method according to claim 7, characterized in that a first spoiler gradient is switched before the readout window.

14. Imaging method according to claim 7 or 8, characterized in that the RF excitation pulses are irradiated in layer-selective manner.

15. Imaging method according to claim 9, characterized in that before the readout window is switched a second spoiler gradient and between the first and second spoiler gradients a frequency-selective saturation pulse is irradiated for suppressing an interfering signal.

16. Imaging method according to claim 7 or 8, characterized in that the RF excitation pulses are frequency-selective.

17. Imaging method according to one of the claims 1 to 6, characterized in that before the second readout window precisely two phase coding gradients are switched for phase coding in two spatial directions and before the next RF excitation pulse precisely two phase coding gradients are switched for cancelling out a phase coding in the two spatial directions.

18. Imaging method according to one of the claims 1 to 6, characterized in that before the first readout window precisely three phase coding gradients are switched for phase coding in three spatial directions and before the next RF excitation pulse precisely three phase coding gradients are switched for cancelling out a phase coding in the three spatial directions.

19. Imaging method according to claim 17 dependent on claim 5, characterized in that after the first readout window and before the second readout window successively precisely two phase coding gradients are switched for cancelling out the phase coding in two spatial directions and precisely two phase coding gradients are switched for phase coding in two spatial directions.

20. Imaging method according to claim 18 dependent on claim 5, characterized in that after the first readout window and before the second readout window successively precisely three phase coding gradients are switched for cancelling out the phase coding in three spatial directions and precisely three phase coding gradients are switched for phase coding in three spatial directions.

21. Imaging method according to one of the claims 7 to 16, characterized in that before the readout window precisely two phase coding gradients are switched in two spatial directions and before the next RF excitation pulse precisely two phase coding gradients are switched for cancelling out a phase coding in the two spatial directions.

22. Imaging method according to one of the claims 7 to 16, characterized in that before the readout window precisely three phase coding gradients are switched for phase coding in three spatial directions and before the next RF excitation pulse precisely three phase coding gradients are switched for cancelling out a phase coding in the three spatial directions.

23. Spectroscopic imaging method using a SSFP RF excitation pulse sequence with the following features:

- with a repetition time (TR) RF excitation pulses with a flip angle are irradiated onto a test object and

- between the RF excitation pulses, in a first readout window and under at least one readout gradient oscillating in one spatial direction, a FID-like SSFP signal S1 is read out and in a second readout window separate from the first readout window and under at least one readout gradient oscillating in one spatial direction an echo-like SSFP signal S2 is read out.

24. Imaging method according to claim 23, characterized in that the FID-like SSFP signal S1 and the echo-like SSFP signal S2 are in each case read out under precisely one oscillating readout gradient, before the first readout window one or two phase gradients are switched for phase coding in one or two spatial directions and before the next RF excitation pulse one or two phase coding gradients are switched for cancelling out a phase coding in one or two spatial directions.

25. Imaging method according to claim 23, characterized in that the FID-like SSFP signal S1 and the echo-like SSFP signal S2, are in each case read out under precisely two readout gradients oscillating in different spatial directions and before the first readout window precisely one phase coding gradient is switched for phase coding in one spatial direction and before the next RF excitation pulse precisely one phase coding gradient is switched for cancelling out a phase coding in the spatial direction.

26. Imaging method according to claim 23, characterized in that the FID-like SSFP signal S1 and the echo-like SSFP signal S2 are in each case read out under precisely three readout gradients oscillating in different spatial directions.

27. Imaging method according to one of the claims 23 to 26, characterized in that the separation of the first and second readout windows takes place by switching a first spoiler gradient between the FID-like SSFP signal S1 and the echo-like SSFP signal S2.

28. Imaging method according to one of the claims 23 to 27, characterized in that the RF excitation pulses are irradiated in layer-selective manner.

29. Imaging method according to claim 28, characterized in that a second spoiler gradient is switched between the FID-like SSFP signal S1 and the echo-like SSFP signal S2 and a frequency-selective saturation pulse is irradiated between the first and second spoiler gradients for suppressing an interfering signal.

30. Imaging method according to claim 28 or 29, characterized in that after the first readout window and before the second readout window successively at least one phase coding gradient is switched for cancelling out the phase coding in at least one spatial direction and at least one phase coding gradient is switched for phase coding in at least one spatial direction.

31. Imaging method according to one of the claims 23 to 27, characterized in that the RF excitation pulses are frequency-selective.

32. Spectroscopic imaging method using a SSFP RF excitation pulse sequence having the following features:

- with a repetition time (TR) RF excitation pulses with a flip angle are irradiated onto a test object and

- between the RF excitation pulses and in a single readout window under at least one readout gradient oscillating in one spatial direction, a single FID-like SSFP signal S1 is read out.

33. Imaging method according to claim 32, characterized in that the FID-like SSFP signal S1 is read out under precisely one readout gradient oscillating in one spatial direction, before the readout window one or two phase gradients are switched for phase coding in one or two spatial directions and before the next RF excitation pulse one or two phase coding gradients are switched for cancelling out a phase coding in one or two spatial directions.

34. Imaging method according to claim 32, characterized in that the FID-like SSFP signal S1 is read out under precisely two readout gradients oscillating in different spatial directions and before the readout window precisely one phase

coding gradient is switched for phase coding in one spatial direction and before the next RF excitation pulse precisely one phase coding gradient is switched for cancelling out a phase coding in the spatial direction.

35. Imaging method according to claim 32, characterized in that the FID-like SSFP signal S1 is read out under precisely three readout gradients oscillating in different spatial directions.

36. Imaging method according to one of the claims 32 to 35, characterized in that a first spoiler gradient is switched after the readout window.

37. Imaging method according to one of the claims 32 to 36, characterized in that the RF excitation pulses are irradiated in layer-selective manner.

38. Imaging method according to claim 37, characterized in that a second spoiler gradient is switched after the readout window and between the first and second spoiler gradients is irradiated a frequency-selective saturation pulse for suppressing an interfering signal.

39. Imaging method according to one of the claims 32 to 36, characterized in that the RF excitation pulses are frequency-selective.

40. Spectroscopic imaging method using a SSFP RF excitation pulse sequence having the following features:

- with a repetition time (TR) RF excitation pulses with a flip angle are irradiated onto a test object and

- between the RF excitation pulses and in a single readout window under at least one readout gradient oscillating in one direction, a single echo-like SSFP signal S2 is read out.

41. Imaging method according to claim 40, characterized in that the echo-like SSFP signal S2 is read out under precisely one readout gradient oscillating in one spatial direction, before the readout window one or two phase gradients are switched

for phase coding in one or two spatial directions and before the next RF excitation pulse one or two phase coding gradients are switched for cancelling out a phase coding in one or two spatial directions.

42. Imaging method according to claim 40, characterized in that the echo-like SSFP signal S2 is read out under precisely two readout gradients oscillating in different spatial directions and before the readout window precisely one phase coding gradient is switched for phase coding in one spatial direction and before the next RF excitation pulse precisely one phase coding gradient is switched for cancelling out a phase coding in the spatial direction.

43. Imaging method according to claim 40, characterized in that the SSFP echo signal S2 is read out under precisely three readout gradients oscillating in different spatial directions.

44. Imaging method according to one of the claims 40 to 43, characterized in that a first spoiler gradient is switched after the readout window.

45. Imaging method according to one of the claims 40 to 44, characterized in that the RF excitation pulses are irradiated in layer-selective manner.

46. Imaging method according to claim 45, characterized in that a second spoiler gradient is switched after the readout window and a frequency-selective saturation pulse is irradiated between the first and second spoiler gradients for suppressing an interfering signal.

47. Imaging method according to one of the claims 40 to 44, characterized in that the RF excitation pulses are frequency-selective.

48. Imaging method according to one of the preceding claims, characterized in that the signals S1 and/or S2 are detected with a single RF coil.

49. Imaging method according to one of the claims 1 to 47, characterized in that the signals S1 and/or S2 are detected with at least two RF coils with spatially different sensitivity profiles.

50. Apparatus with means for performing a method according to one of the preceding claims.

51. Apparatus according to claim 50, characterized in that the apparatus is a magnetic resonance apparatus.

52. Apparatus according to claim 51, characterized in that the magnetic resonance apparatus is a nuclear spin tomography apparatus or a nuclear spin spectroscopy apparatus or a combination thereof.

53. Use of a method according to one of the claims 1 to 49 for material characterization.

54. Use of a method according to one of the claims 1 to 49 for characterizing ageing processes.